

# User's Manual

## Two-axis Stage Controller

SHOT-702



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## For Your Safety




Before using this product, read this manual and all warnings or cautions in the documentation provided.

Only Factory Authorized Personnel should be changes and/or adjust the parts of controller.

### The Symbols Used in This Manual


 <b>WARNING</b>	 <b>CAUTION</b>
This symbol marks warnings that should be read and used to prevent serious injury or death.	This symbol indicates where caution should be used to avoid possible injury to yourself or others, or damage to property.

The above indications are used together with the following symbols to indicate the exact nature of the warning or caution.

Examples of Symbols Accompanying Warnings and Cautions	
	△ Symbols enclosed in a triangle indicate warnings and cautions. The exact nature of the warning or caution is indicated by the symbol inside (the symbol at left indicates risk of electrocution).
	○ Symbols enclosed in a circle mark indicate prohibitions (actions that must not be performed). The exact nature of the prohibition is indicated by the symbol inside or next to the circle mark (the symbol at left indicates that the product must not be disassembled).
	● Symbols inside a black circle mark actions that must be performed to ensure safety. The exact nature of the action that must be performed is indicated by the symbol inside (the symbol at left is used in cases in which the AC adapter must be unplugged to ensure safety).

### Symbols on the product

The symbol mark on the product calls your attention. Please refer to the manual, in the case that you operate the part of the symbol mark on the product.

	This symbol labeled on the portion calls your attention.
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### Disclaimer of Liability

- ① SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product or the inability to use this product.
- ② SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product that deviates from that described in the manual.
- ③ SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product in extraordinary conditions, including fire, earthquakes, and other acts of God, action by any third party, other accidents, and deliberate or accidental misuse.
- ④ If the equipment is used in a manner not specified by the SIGMAKOKI CO., LTD., the protection provided by the equipment may be impaired.



### WARNING

- Do not use this product in the presence of flammable gas, explosives, or corrosive substances, in areas exposed to high levels of moisture or humidity, in poorly ventilated areas, or near flammable materials.
- Do not connect or check the product while the power is on.
- Installation and connection should be performed only by a qualified technician.
- Do not bend, pull, damage, or modify the power or connecting cables.
- Do not touch the products internal parts.
- Connect the earth terminal to ground.
- Should the product overheat, or should you notice an unusual smell, heat, or unusual noises coming from the product, turn off the power immediately.
- Do not turn on the power in the event that it has received a strong physical shock as the result of a fall or other accident.
- Do not touch the stage while operation.
- Use dry clothes only for cleaning the equipment.

## Chapter 1: Before You Begin

### 1.Package Contents

Purchasers of the Stage Controller should find that the package contains the items listed below. Check the package contents using the following checklist. Contact your retailer as soon as possible in the event that you should find that any item is missing or damaged.

<input type="checkbox"/> SHOT-702 Stage Controller	:1
<input type="checkbox"/> User's Manual (This Manual)	:1
<input type="checkbox"/> AC Power Cable	:1

About the setting of the Memory Switch of this controller, you can set it by sample software.

You can download sample programs from our web page.

For the details of the samples, see the manual of each program.

View our home page <http://www.sigma-koki.com/>

### 2. Overview

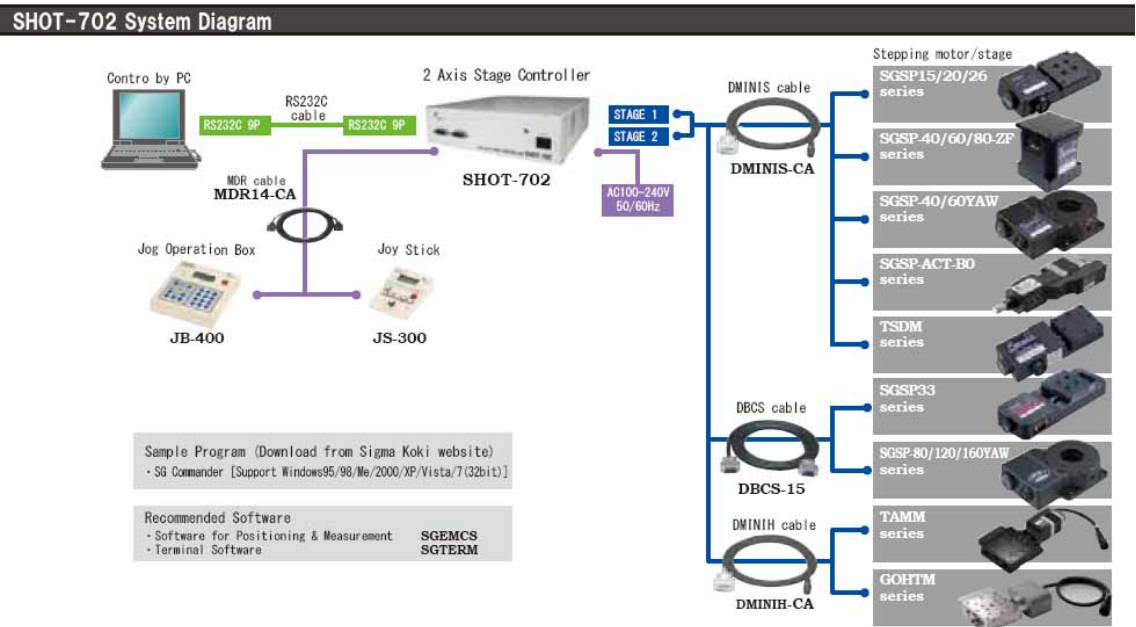
This controller is two axes stage controller, which has drivers for five-phase stepping motor.

Because this controller has a microstep driver built-in, the smooth movement in high resolving power is possible.

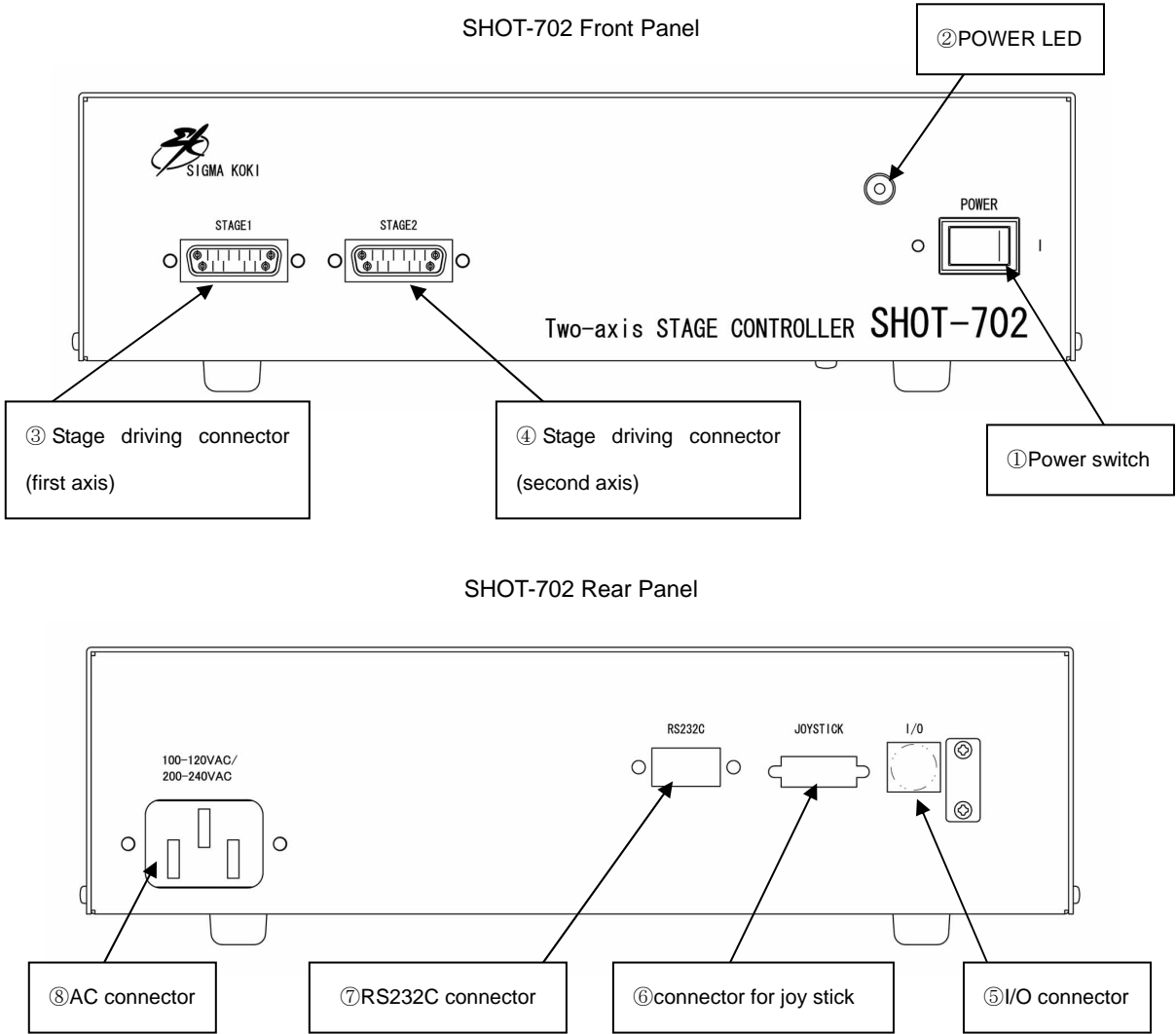
When the SHOT-702 is connected to an ordinary personal computer via an RS232C interface, the stage can be accurately moved to the desired position by simple commands sent from the PC.

In addition, manual operation is possible facility by connecting JOYSTICK (an optional product).

3. The SHOT-702 System



4. Parts of the SHOT-702



## Functions:

- ① Power switch : The product is on when the switch is set to ON. Set the switch to OFF to turn the product off.
- ② POWER LED : Lights up when powered.
- ③,④ Stage driving connector : Connect to the motorized stage of your choice. Supports up to two axes.
- ⑤ I/O connector : The connector accepts a cable for sending and receiving I/O and control signals to form an external device. It can also be used to drive motorized stages remotely or to start programmed operations.
- ⑥ Connector for joy stick : This connector is used to connect JS-300 or JB-400 or JD-100.
- ⑦ RS232C connector : This connector is used when the device is controlled from the computer via an RS232C interface.
- ⑧ AC connector : This is where you connect the supplied 2.3meter power cable.

## ● USABLE DETACHABLE POWER CORDS

Type	Connector	Cord	Attachment plug cap
AC100-120V	Use the detachable power cord set attached to the product only.		
AC200-240V	IEC C-22 Rated 7A, 250V UL, CSA Approved	Type SJT, No16 AWG Min. 3-Conductors (Single phased;2-current carrying & ground) UL, CSA Approved	NEMA6-15P Tandem blade Rated 7A,250V UL, CSA Approved

Cable length of above Power Supply cord shall be shorter than 4.5m.



## Chapter 2: Basic Operations

### 5.SHOT-702 Connection procedure

#### 5-1.Connecting to Motorized Stages

First, connect SHOT-702 to the motorized stages.

- ② Please confirm the power switch of the SHOT-702 is turning off.
- ② Connect a standard cable (D15RP-CA/D15D15A-CA/DMINIS-CA/DBCS-15/DMINIH-CA) to the connector of the motorized stage.
- ③ Connect the stage to be controlled as the first axis to the STAGE1 connector of the SHOT-702 controller. Also connect the stage controlled as the second axis to the STAGE2 connector.

#### 5-2.Connecting to PC and peripheral device

Connect SHOT-702 to PC and peripherals (JS-300/JB-400/JD-100).

RS232C interface is used for the connection between the PC and SHOT-702.

The RS232C interface communication parameter of the SHOT-702 is described below. Please set the configurations of the PC side according to the following table.

Parameter	Descriptions
Baud rate	38400bps
Delimiters	CR+LF
Parity	None
Data bits	8bit
Stop bit	1bit
Flow control	Hardware (RTS/CTS) or none (Default value is Hardware)

- ① Please confirm the power switch of the SHOT-702 is turning off.
- ② Use a genuine cable RS232C/STR, or 9-pin, D-SUB straight cable with male/female ends using inch screw threads.
- ③ Insert the male connector of communications cable in to the RS232C connector on the SHOT-702.  
Insert the female end into the serial port on your PC.  
Please connect peripheral device according to the procedure from ④ to ⑥ if you use it.
- ④ Please use a special cable MDR14-CA for the connection of peripheral device.
- ⑤ The one side of MDR14-CA is connected with the connector of the peripheral device.
- ⑥ The connector on the other side of MDR14-CA is connected with the JOYSTICK connector of SHOT-702.

#### 5-3.Connecting Power Cable

Connect the supplied power cable to the AC connector on the rear panel of SHOT-702 to plug the cable into an outlet. (Ensure that it is grounded.)

## 6.SHOT-702 Setting

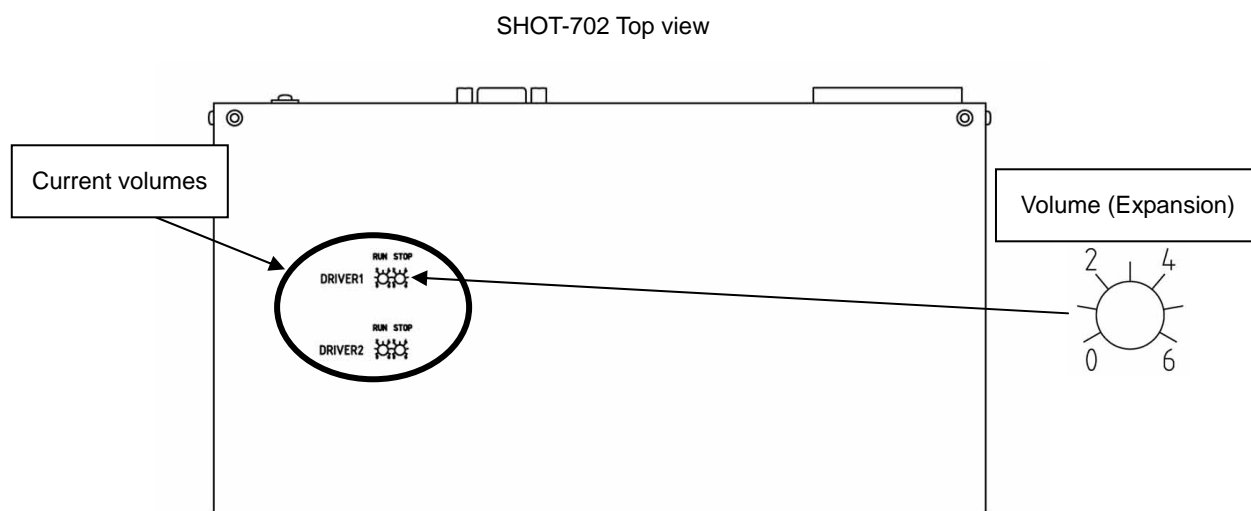
Adjust the drive (RUN/STOP) current and memory switch of controller for each of the connected motorized stages.

### 6-1.Setting the drive current

Set current values supplied from SHOT-702 to stages. Turn a RUN current volume, provided on the top of the unit, to adjust RUN current corresponding to the stages to use. Use a STOP current volume to set a ratio to RUN current according to your conditions for the case where the current down function works. You can make each current adjustment for first axis or second axis independently.

Note that for the STOP current, adjustment is available not for current values, but for a ratio (%) to the RUN current.

Note: Generally the ratio of the STOP current to the RUN current is approx. 50%.



RUN current setting (Factory-set to 0.75)

Volume No.	0	1	2	3	4	5	6
Run current [A/phase]	0	0.17	0.35	0.66	0.75	0.9	1.1

STOP current settings (Factory-set to 50%)

Volume No.	0	1	2	3	4	5	6
Stop current (%)	0	10	21	35	50	60	68

### 6-2. Setting Memory Switch

SHOT-702's various settings are set with Memory Switch.

The setting change of Memory Switch is set with the sample software (SGSample/ SGCommander).

Please download SGSample/SGCommander from homepage (<http://www.sigma-koki.com>).

## 6-3.Memory Switch List

The memory switch has 44 setting items in all. Please set a necessary item.

No	Memory switch setting	Range/ options	Default value
1	Speed SEL	1 ~ 4	1
2	Speed 1(S)	1 ~ 500000	100
3	Speed 1(F)	1 ~ 500000	1000
4	Speed 1(R)	1 ~ 1000	200
5	Speed 2(S)	1 ~ 500000	500
6	Speed 2(F)	1 ~ 500000	5000
7	Speed 2(R)	1 ~ 1000	200
8	Speed 3(S)	1 ~ 500000	750
9	Speed 3(F)	1 ~ 500000	7500
10	Speed 3(R)	1 ~ 1000	200
11	Speed 4(S)	1 ~ 500000	1000
12	Speed 4(F)	1 ~ 500000	10000
13	Speed 4(R)	1 ~ 1000	200
14	COMM/ACK	MAIN/SUB	MAIN
15	Stage1 Unit	PULSE/MICRO/DEG	PULSE
16	Stage2 Unit	PULSE/MICRO/DEG	PULSE
17	Divide1	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	2
18	Divide2	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	2
19	Base Rate1	1 ~ 1000	20
20	Base Rate2	1 ~ 1000	20
21	L sensor Level1	Normal Open/Normal Close	NM CLOSE
22	L sensor Level2	Normal Open/Normal Close	NM CLOSE
23	O sensor Level1	Normal Open/Normal Close	NM OPEN
24	O sensor Level2	Normal Open/Normal Close	NM OPEN
25	N sensor Level1	Normal Open/Normal Close	NM OPEN
26	N sensor Level2	Normal Open/Normal Close	NM OPEN
27	Move1	POS/NEG	POS
28	Move2	POS/NEG	POS
29	ORG1 SEL	MINI/MARK/NORM/CENTER/OFF	MINI
30	ORG2 SEL	MINI/MARK/NORM/CENTER/OFF	MINI
31	ORG1 Speed(S)	1 ~ 500000	500
32	ORG1 Speed(F)	1 ~ 500000	5000
33	ORG1 Speed(R)	1 ~ 1000	200

34	ORG2 Speed(S)	1~500000	500
35	ORG2 Speed(F)	1~500000	5000
36	ORG2 Speed(R)	1~1000	200
37	ORG1 Pulse2	0~32000	0
38	ORG2 Pulse2	0~32000	0
39	Acceleration1	Linear/S Curve	S Curve
40	Acceleration2	Linear/S Curve	S Curve
41	EMG Excitation1	On/Off	On
42	EMG Excitation2	On/Off	On
43	OUT Level	Normal High/Normal Low	NM High
44	Flow Control	On/Off	On

#### 6-4.Memory Switch Settings in Detail

The numbers in each heading indicate the number of the memory switch setting item for the SHOT-702

##### 1) SPEED SEL: Speed selection

Choose the initial speed setting used at power on.

[Options] 1 to 4

##### 2~13) SPEED 1 to 4 (S) (F) (R): Speed settings

Set the travel speed of stage (minimum S, maximum F, and acceleration/deceleration time R)

[Options] S : 1 to 500000PPS

F : 1 to 500000PPS

R : 1 to 1000ms

Note: The minimum speed (S) must be less than or equal to the maximum speed (F).

##### 14) COM/ACK: Choose the communication protocol used when communicating with the computer.

Specify whether the controller will return OK/NG in response to command signals sent from the computer in HOST (COMPUTER) mode.

[Options] MAIN : New system (return OK/NG when using interface)

SUB : Old system (do not return OK/NG when using interface)

##### 15) STAGE1 UNIT: Select the units used for display (first axis)

##### 16) STAGE2 UNIT: Select the units used for display (second axis)

Choose the units used to display position coordinates of peripheral device (JS-300/JB-400).

No need to set the units in case that there is no using of peripheral device (JS-300/JB-400).

[Options] PULSE : Displays number of pulses

MICRO : Displays number of micro [ $\mu$  m]

DEG : Display number of degree [ $^{\circ}$  ]

**17) Divide1:** Select number of steps for 1

**18) Divide2:** Select number of steps for 2

[Options] 1,2,4,5,8,10,20,25,40,50,80,100,125,200,250

Number of steps = Divide = BASE RATE (in 0.1 $\mu$ m steps)/ (10 X travel per pulse (in  $\mu$ m))

**19) BASE RATE1:** Travel per pulse at the base (full) step for the first axis

**20) BASE RATE2:** Travel per pulse at the base (full) step for the second axis

Input the travel per pulse at the base (full) step for each axis. (MICRO: in 0.1- $\mu$ m steps, DEG: in 0.001-degree steps)

[Options] At a setting of PULSE: Disabled

At a setting of MICRO: 1 to 1000 (0.1 $\mu$ m to 100 $\mu$ m)

At a setting of DEG: 1 to 1000 (0.001 degrees to 1 degree)

<Settings example> BASERATE = 40 for a directly motorized stage with screw lead of 2mm

Stage	XYZ linear stage					Rotation stage
Screw lead	0.5mm	1mm	2mm	6mm	10mm	-
Base step angles	0.72°					
Travel per pulse at base step	1 $\mu$ m	2 $\mu$ m	4 $\mu$ m	12 $\mu$ m	20 $\mu$ m	0.005°
BASE RATE	10	20	40	120	200	5

**21) L sensor Level1:** Specify the input logic for the first-axis limit sensor

**22) L sensor Level2:** Specify the input logic for the second-axis limit sensor

Select the conditions (input logic) for the limit sensor for each axis.

[Options] NORMAL OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

NORMAL CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

Motorized stages that support normal closed method: OSMS/ HPS/ HDS/ SGSP/ TSDM /TAMM/ GOHTM series.

**23) O sensor Level1:** Specify the input logic for the first-axis ORG sensor

**24) O sensor Level2:** Specify the input logic for the second-axis ORG sensor

Select the conditions (input logic) for the ORG sensor for each axis.

[Options] NORMAL OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

NORMAL CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

Motorized stages that support normal open method: OSMS/HPS/HDS/TAMM/GOHTM series.

**25) N sensor Level1:** Specify the input logic for the first-axis NEAR sensor

**26) N sensor Level2:** Specify the input logic for the second-axis NEAR sensor

Select the conditions (input logic) for the NEAR sensor for each axis.

[Options]                      NORMAL OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

                                    NORMAL CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

**27) Move1:** Direction of travel for first axis

**28) Move2:** Direction of travel for second axis

Select the + direction for each axis

[Options]                      POS: Positive (forward) rotation

                                    NEG: Negative (reverse) rotation

**29) ORG1 SEL:** Specify method used for return to first axis origin

**30) ORG2 SEL:** Specify method used for return to second axis origin

[Option]                      MINI       :MINI method

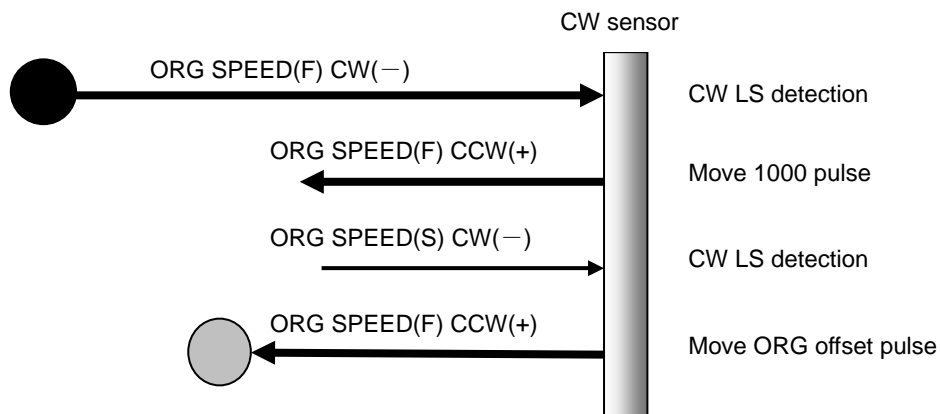
                                    MARK       :MARK method

                                    NORMAL   :Standard method

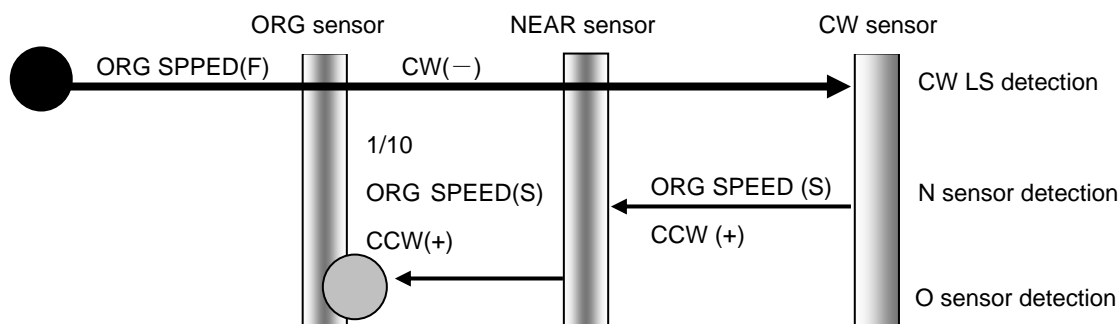
                                    CENTER   :Median point detection method

                                    OFF        :Not return origin

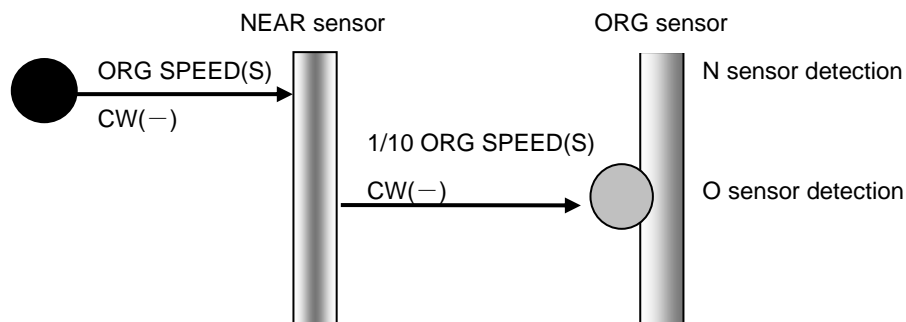
• MINI method



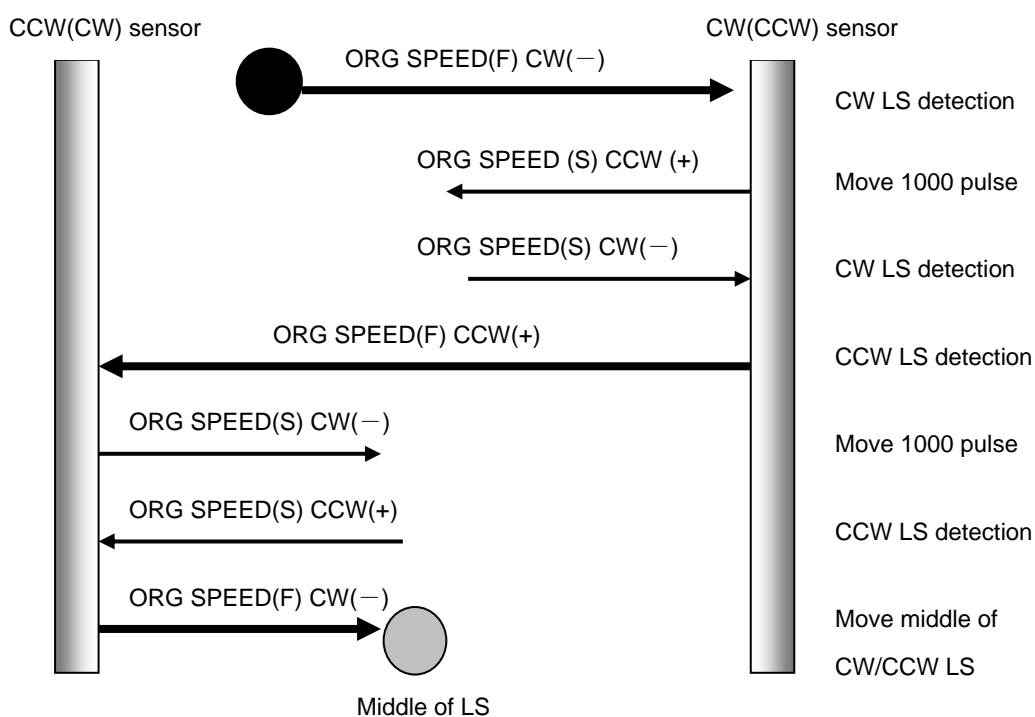
• MARK method



- standard method



- median point detection method



### 31)~36) ORG1/2 SPEED (S)(F)(R): Specify speed when returning to origin

Set the travel speed of stage (minimum S, maximum F, and acceleration/deceleration time R)

When returning to the mechanical origin for the stage on each axis.

[Options] S: 1 to 500000PPS

F: 1 to 500000PPS

R: 1 to 1000ms

**Note: The minimum speed (S) must be less than or equal to the maximum speed (F).**

**37) ORG1 Pulse2:** Set ORG offset of the first axis when MINI method set

**38) ORG2 Pulse2:** Set ORG offset of the second axis when MINI method set

Set the travel (number of pulses) of ORG offset of each axis when MINI method set.

Default value is 0. Division  $\times$  500 pulse move

[Option] 0 to 32000 (unit:1=100pulse)

**39) Acceleration1:** Set the speed-acceleration profile of the first axis

**40) Acceleration2:** Set the speed-acceleration profile of the first axis

[Options] Linear :trapezoidal control

S Curve :S curve control

**41) EMG Excitation1:** Set the excitation ON/OFF of the first axis when the emergency stop

**42) EMG Excitation2:** Set the excitation ON/OFF of the second axis when the emergency stop

[Options] ON :Excitation

OFF :Free motor

**43) TRG Level:** Logical settings for trigger output

Set the output signal level of I/O function.

[Option] Normal High: When outputting signal, it becomes LOW.

Normal Low: When outputting signal, it becomes HI.

**44) Flow Control:** Flow control selection

Specify whether the controller will do flow control in RS232C communication.

[Option] ON: Hardware (RTS/CTS)

OFF: None



## Chapter 3: Using SHOT-702 to position Motorized Stages

### 7.Using Computer to position Motorized Stages

The controller can be connected to a computer using an RS232C interface. Motorized stages can then be precisely controlled by commands (strings) transmitted from the computer.

#### 7-1. List of Commands

The following is a list of available commands:

Command	String	Details
Return to mechanical origin	H :	Detect mechanical origin
Set number of pulses for relative movement	M :	Axis of movement, direction, number of pulses
Set number of pulses for absolute movement	A :	Absolute coordinates
Jog command	J :	Move at minimum speed (S)
Drive command	G :	Start
Stop command	L :	Stop
Set electronic (logical) origin	R :	Set the electronic (logical) origin to the current position
Speed settings	D :	Set S, F and R
ORG speed setting	V :	Set S, F and R of ORG
Free motor	C :	Excitation ON/OFF
Switch number of steps	S :	Switch number of steps
Status1	Q :	Return current position etc.
Status2	! :	Return B(busy)/R(ready)
Internal information	? :	Check internal information
Output	O :	Output to I/O connector
Input	I :	Input from I/O connector

## 7-2. Command Format

The communications protocol used between the controller and the computer depends on the memory switch COMM/ACK.

### 1. When COMM/ACK is set to MAIN (new system):

A protocol is used in which one response is issued for each command.

Command string ..... receive

Response string ..... sent

The response string when a command is received normally is "OK," that when the command was not received, "NG." In some cases, for example in response to confirmation commands, data will be returned instead of "OK." Commands should only be sent after checking the internal status of the controller.

### 2. When COMM/ACK is set to SUB (old system):

A protocol is used in which the controller does not respond to each command. Data will however be returned in response to some commands, such as confirmation commands.

To determine whether or not a command was received normally, use the Q command to check status.

## 7-3. Command in Detail

### (1) H command: Return to mechanical origin

Features: This command is used to detect the mechanical origin for a stage and set that position as the origin. Once the mechanical origin has been detected, the value displayed will be 0. The stage will move at the speed specified in the ORG1 (2) SPEED (S, F, R) memory switches.

H: 1 Detect the mechanical origin for the first axis.

H: 2 Detect the mechanical origin for the second axis.

H: W Detect the mechanical origin for the first and second axes.

### (2) M command: Set number of pulses for relative travel

Features: This command is to specify the axis of travel, direction, and the travel (number of pulses).

This command must always be followed by a drive (G) command. Travel is by means of acceleration/deceleration driving. The distance traveled is specified in pulses.

M: 1+P1000 Travel 1000 pulses in the + direction on the first axis

G:

M: 2- P 10000 Travel 10000 pulses in the - direction on the second axis

G:

M: W+P500-P200 Travel 500 pulses in the + direction on the first axis and 200 pulses in the -

G: direction on the second axis

**(3) A command:** Set number of pulses for absolute travel

Features: This command is to specify the axis of travel, direction, and the travel (number of pulses).

This command must always be followed by a drive (G) command. Travel is by means of acceleration/deceleration driving.

The distance traveled is specified in the number of pulses depending on the control method. This command also returns the axis to the electrical (logical) origin.

A: 1-P2000          Travel to the 2000 pulse position in the - direction on the first axis.

G:

A: 2+P30000        Travel to the 30000 pulse position in the + direction on the second axis.

G:

A: W+P1000-P2000          Travel to the 1000 pulse position in the + direction on the first axis and

G:                                  the 2000 pulse position in the - direction on the second axis

**(4) J command:** JOG

Features: This command drives stages continuously (at a constant speed) at the starting speed (S).

This command must always be followed by a drive (G) command.

J:1+    move in the + direction on the first axis.

G:

J:2-    move in the - direction on the second axis.

G:

J:W-+    move in the - direction on the first axis and in the + direction on the second axis

G:

**(5) G command:** Drive

Features: When a drive command is issued, the stage starts moving, moves the specified number of pulses, and then stops. The G command is used after M, A, and J commands.

G:                          Drive

G                          Drive

**(6) L command:** Decelerate and stop

Features: When this command is executed, the stage decelerates and stops.

L:1    First axis decelerates and stops

L:2    Second axis decelerates and stops

L:W    First- and second-axis decelerate and stop

**(7) L: E command:** Emergency stop

Features: This command stops all stages immediately, whatever the conditions.

L:E Stop first and second axes immediately

**(8) R command:** Set electronic (logical) origin

Features: This command is used to set electronic (logical) origin to the current position of each axis.

R:1 Set the electronic (logical) origin for the first axis

R:2 Set the electronic (logical) origin for the second axis

R:W Set the electronic (logical) origins for the first- and second-axis

**(9) D command:** Speed settings

Features: The minimum speed (S), maximum speed (F), and acceleration/deceleration time (R) are set according to the SPEED SEL memory switches when the power is turned on. This command allows you to change these initial settings.

The following options are available:

Minimum speed(S) 1~500000PPS

Maximum speed (F) 1~500000PPS

Acceleration/deceleration time (R) 1~1000mS

Note that the minimum speed (S) must be less than or equal to the maximum speed (F).

D:1S100F1000R50 Adjust speed settings for the first axis (S=100PPS/F=1000PPS/  
R=50ms)

D:2S1000F5000R200 Adjust speed settings for the second axis (S=1000PPS/F=5000PPS/  
R=200ms)

D:WS100F1000R200S100F1000R200 Adjust speed settings for the first- and second-axis

First-axis speed settings

Second-axis speed settings

**(10) V command:** ORG speed settings

Features: ORG speed (minimum speed (S), maximum speed (F), and acceleration/deceleration time (R)) is set according to the SPEED SEL memory switches when the power is turned on. This command allows you to change these initial settings.

The following options are available:

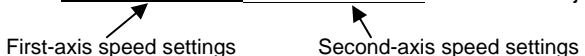
Minimum speed(S)	1~500000PPS
Maximum speed (F)	1~500000PPS
Acceleration/deceleration time (R)	1~1000mS

Note that the minimum speed (S) must be less than or equal to the maximum speed (F).

V:1S100F1000R50      Adjust ORG speed settings for the first axis (S=100PPS/F=1000PPS/R=50ms)

V:2S1000F5000R200      Adjust ORG speed settings for the second axis (S=1000PPS/F=5000PPS/R=200ms)

V:WS100F1000R200S100F1000R200      Adjust speed settings for the first- and second-axis



**(11) C command:** Free/ hold motor (Excitation ON/OFF)

Features: This command is used to excite the motor or to turn excitation off, making it possible to move (rotate) stages manually.

The options available are 0: free motor, and 1: excitation (hold motor).

C:10	Free first-axis motor
C:21	Excite (hold) second-axis motor
C:W1	Excite (hold) both the first- and second-axis motors

**(12) S command:** Changing the number of steps

Features: Use this command to change motor step angle (number of steps). Select one of the following 15 step angles built into the driver. First specify an axis, then set the value.

S: 180 Divides the step angle of the first axis into 80 angles.

S: 280 Divides the step angle of the second axis into 80 angles.

If the base step (full step) angle is to 0.72 degrees, the stepping motor makes one full turn every 500 pulses. The motor is said to have a minimum resolution of 0.72 degrees (if the motor moves 10 mm for each turn, minimum resolution=10 mm ÷ 500 pulses=20 μm). You can change the minimum resolution by dividing the motor step angle (1/2=0.36°).

Number of steps	1	2	4	5	8	10	20	25	40	50	80
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.036°	0.0288°	0.018°	0.0144°	0.009°
Number of pulses per full turn	500	1000	2000	2500	4000	5000	10000	12500	20000	25000	40000
Number of steps	100	125	200	250							
Step angle	0.0072°	0.00576°	0.0036°	0.00288°							
Number of pulses per full turn	50000	62500	100000	125000							

**(13) Q command: Status 1**

Features: On receipt of this command, the controller returns the coordinates for each axis and the current state of each stage.

Q:

— 100, — 200, ACK1, ACK2, ACK3 ..... Data returned

First-axis              Second-axis              Three-character  
coordinates              coordinates              string data

ACK1 ..... X: Command or parameter errors.

K : Command received normally.

ACK2 ..... L : First axis stopped at LS

M: Second axis stopped at LS

W: First and second axes stopped at LS

K : Normal stop

ACK3 ..... B: (BUSY) L, Q, and ! commands can be received

R: (READY) all commands can be received

※Coordinate values for each axis have a fixed length of ten digits, including symbols

(Symbols are left-aligned, coordinates values right-aligned).

**(14) ! command:** Status 2

Features: On receipt of this command, the controller returns the stage operating status.

! :

ACK3 ..... Data returned

ACK3 ..... B:(BUSY) L, Q, !, and P commands can be received

R:(READY) all commands can be received

**(15) ? command:** Request for internal information

Features: This command returns controller settings.

?: [Parameter] [AXIS]

Parameter	Data returned	Examples
V	Version numbers	V1.00
P	Travel per pulse	1.00,1.00
S	Division	2,2
D	Travel speed	S100F1000R200
B	ORG speed	S500F5000R200

**(16) O command:** Output

Features: This command changes the output status.

[Option] O:0 Set the output signal to Normal level (Default value: High)

O:1 Output signal (Default value: Signal will be Low level when outputting signal )

**(17) I command:** input

Features: This command checks the input status. Signal level is active low.

[Option] I:

0 or 1 ...Data returned

0: negative

1: active

## 8.Using I/O signal

SHOT-702 has following I/O signal functions.

- Output-1 point
- Emergency stop input-1 point
- Busy signal output-1 point
- Input-1 point (photo-coupler input)

### ①Output

This is output port. Output signal can be controlled by O command.

Output logic is switchable by memory switch. Default value is normal HI.

### ②Busy signal output

Outputting signal when motorized stages moving.

Busy signal level is switchable by memory switch. Default value is normal HI.

### ③Input

This is input port. Input signal can be checked by I command.

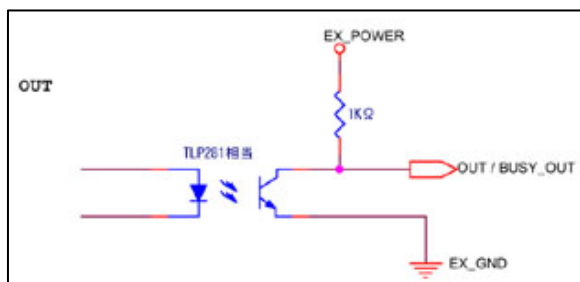
Input logic is active low.

### ④EMG STOP input

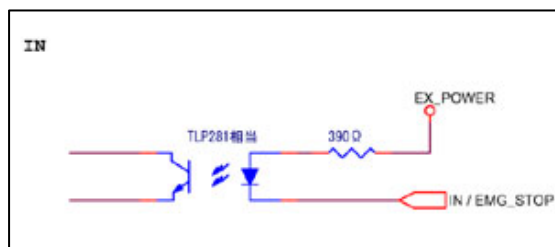
EMG STOP is photo-coupler input (8-2).

EMG STOP turns on when the current passes in TLP281 by EMG STOP terminal being connected to ground. PC or peripheral device can't move Motorized stages when EMG STOP signal turns on.

If EMG STOP signal turn off, motorized stages can move again. However, controller is necessary to turn on the power supply again because it enters the state that cannot be operated due to the communication fault when there are communication statements from PC while EMG STOP turns on.



8-1 OUT/BUSY\_OUT circuit



8-2 IN/EMG\_STOP circuit



## **9. Using peripheral device to Position Motorized Stages**

The controller can be connected to a peripheral device (JS-300/JB-400/JD-100). Motorized stages can then be manual controlled and displayed the position coordinates for each axis by peripheral device.

For the details, see the User's manual of peripheral device (JS-300/JB-400/JD-100).

## Chapter 4 : Specification

### 10. Specification

#### 1) General specifications

Power source	AC 100-240V 50/60Hz
Consumption	70VA
Operating temperature	5 to 40°C
Storage temperature	-20 to 60°C
Altitude	up to 2000m
Indoor use only	
Installation category	<b>II</b>
Pollution degree	2
Ambient humidity	20 to 80%RH (no condensation)
External dimensions	260W x280D x70H (excluding projections)
Weight	2.8 kg

#### (2) Performance

Controlling axis	2 axis
Maximum driving speed (F)	1 to 500kPPS
Minimum driving speed (S)	1 to 500kPPS
Acceleration/deceleration time (R)	1 to 1000ms
Sensor input	Origin sensor/proximity sensor/CW (-) limit/CCW (+) limit (Memory switches can be used to change input logic for sensors.)
Method of return to origin	MINI method/MARK method/Standard method Median point detection method/Not return origin (You can change method of ORG by Memory Switch)
Interface	RS232C interface Communication Parameters <ul style="list-style-type: none"> <li>- Baud rate 38400</li> <li>- Data bits 8 bits</li> <li>- Parity None</li> <li>- Stop bit 1 bit</li> <li>- Flow control Hardware</li> <li>- Delimiters CR+LF</li> </ul>

I/O                                      1 input point (photo-coupler input, internal resistance 390  $\Omega$ )  
    1 output point  
    (Open-collector output, maximum use conditions DC24V 50mA)

Control signals                      Emergency stop-1 point  
    (photo-coupler input, internal resistance 390  $\Omega$ )  
    BUSY            1 point  
    (Open-collector output, maximum use conditions DC24V 50mA)

### (3) Driver Specifications

Driver type                              Bi-polar pentagon micro-steps system  
 Driving electric current (output current) 0.1A/phase to 1.1A/phase  
 Current down (stop current)            0.1A/phase to 0.7A/phase  
 Division (micro-step) settings            1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200, 250 divisions

(4) Electrical fast transmit/burst immunity EN61000-4-4 (2004) Level2

(5) Electrical isolation voltage When AC1kV 60Hz is applied between the power terminal and the case for one minute at room temperature and humidity, no abnormality shall occur.

(6) Surge immunity EN61000-4-5 (2006) Level2

(7) Electrostatic discharge EN61000-4-2 (1995)+A1 (1998)+A2 (2001) Level2.

## 11. Connector Pin Numbers and Signals

### 11-1. I/O Connector Signals

No.	Name	No.	Name
1	OUT	5	-
2	Busy	6	GND
3	IN	7	+5V
4	EMG STOP	8	-

HR212-10RA-8SDL (72) (HIROSE products) used

### 11-2. STAGE1,2 Connector

No.	Name	No.	Name
1	Blue: motor wiring	9	-
2	Red: motor wiring	10	-
3	Orange: motor wiring	11	LS (+): limit detection on +
4	Green: motor wiring	12	LS (-): limit detection on-
5	Black: motor wiring	13	GND: common sensor
6	GND: common sensor	14	NEAR: proximity detection
7	ORG: mechanical origin detection	15	+24V: sensor power supply
8	+24V: sensor power supply		

Female XM2F-1510 connector (OMRON products) used

### 11-3. RS232C Connector

No.	Name	No.	Name
1	-	6	DTR
2	TxD	7	CTS
3	RxD	8	RTS
4	DSR	9	-
5	SG		

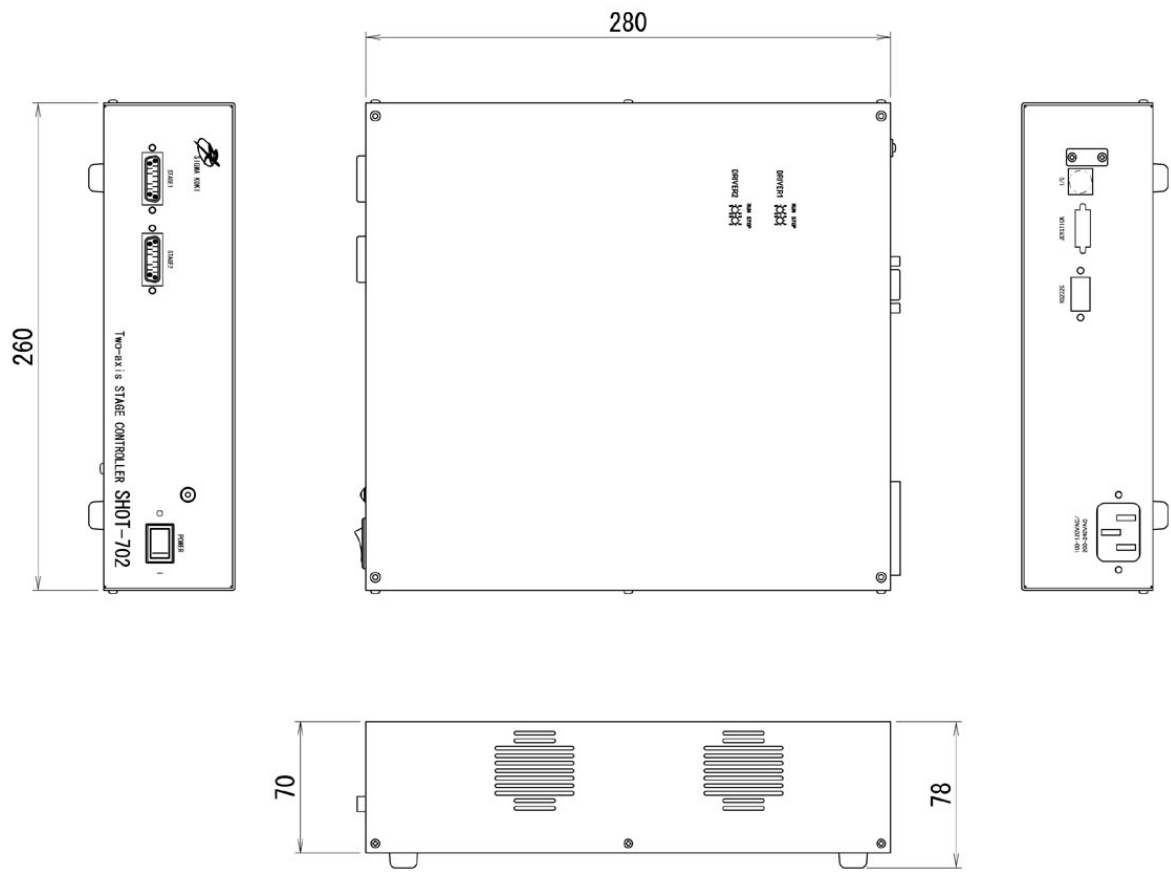
XM3B-0922-132 connector (OMRON products) used

## 11-4. JOYSTICK Connector

No.	Name	No.	Name
1	GND	9	+5V
2	+5V	10	RXD-
3	RXD+	11	TXD-
4	TXD+	12	CONNECT
5	STOP	13	-
6	-	14	-
7	-		
8	GND		

10214-52A2PL (Sumitomo 3M products) used

12. Exterior Dimensions



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